

AGAIN: TAXONOMY OF YELLOW-FLOWERED CAULESCENT OXALIS (OXALIDACEAE) IN EASTERN NORTH AMERICA

Guy L. Nesom

2925 Hartwood Drive
Fort Worth, Texas 76109, U.S.A.
guynesom@sbcglobal.net

ABSTRACT

The taxonomy of *Oxalis* sect. *Corniculatae* is revised for eastern North America and contrasted with previous classifications and circumscriptions, particularly those of Eiten and Lourteig. Eight taxa, some previously recognized as subspecies or varieties, are recognized here at species rank. *Oxalis stricta* L. and *O. dillenii* Jacq. sensu stricto are appropriately identified in the sense that Eiten used the names. *Oxalis florida* Salisb. (= *O. dillenii* subsp. *filipes*) is a distinct species primarily of the Atlantic states and Gulf coast, less common in more inland regions. *Oxalis priceae* Small is a distinct species of the southeastern USA without infraspecific taxa; disjunct populations occur in northeastern Mexico. *Oxalis texana* (Small) Fedde (= *Oxalis priceae* subsp. *texana*) is treated as a distinct species of east Texas and adjacent Louisiana and Arkansas. *Oxalis texana* is close in morphology to *O. dillenii* sensu stricto and occurs sympatrically with it but distinct in geography and morphology from *O. priceae* sensu stricto. *Oxalis illinoensis* Schwegm. is geographically and morphologically distinct from *O. grandis* Small. Neotypes are designated for *O. lyonii* and *O. illinoensis*.

RESUMEN

Se revisa la taxonomía de *Oxalis* sect. *Corniculatae* en el este de Norte América y se contrasta con clasificaciones previas y circunscripciones, particularmente las de Eiten y Lourteig. Ocho taxa, algunos reconocidos previamente como subspecies o variedades, se reconocen aquí en el rango específico. *Oxalis stricta* L. y *O. dillenii* Jacq. sensu stricto se identifican apropiadamente en el sentido en que Eiten usó los nombres. *Oxalis florida* Salisb. (= *O. dillenii* subsp. *filipes*) es una especie distinta primariamente de los estados atlánticos y la costa del Golfo, menos común en las regiones más interiores. *Oxalis priceae* Small es una especie del sureste de USA sin taxa infraespecíficos; con poblaciones disyuntas en el noreste de México. *Oxalis texana* (Small) Fedde (= *Oxalis priceae* subsp. *texana*) se trata aquí como una especie distinta del este de Texas junto con las adyacentes Louisiana y Arkansas. *Oxalis texana* está próxima en la morfología a *O. dillenii* sensu stricto y ocurre simpátricamente con ella pero distinta en geografía y morfología de *O. priceae* sensu stricto. *Oxalis illinoensis* Schwegm. es geográfica y morfológicamente distinta de *O. grandis* Small. Se designan neotipos para *O. lyonii* y *O. illinoensis*.

Yellow-flowered caulescent *Oxalis* (sect. *Corniculatae*) of North America has been the object of interest and study for more than a century. Small (1898, 1903, 1907) described a number of new taxa and brought the names into wide usage; he also treated sect. *Corniculatae* as a separate genus, *Xanthoxalis* Small. Wiegand (1925) provided a detailed and formal overview of the group and recognized many minor variants with formal names, with an emphasis of study on northern North America. Eiten's (1955, 1963) studies distilled the taxonomy to a set of more realistic taxa based on biological concepts rather than typological ones. Lourteig (1979) restudied the group and applied a very different set of names to the taxa, differing in part in the selection of types and in part in concepts of relationships and taxonomic ranks. Useful perspectives on problems of typification and nomenclature have been provided by Watson (1989) and Ward (2004), as noted below. Still, significant problems in identification have remained and confusion persists about which names are appropriate. In restudying, again, the eastern North American plants toward development of a treatment of Oxalidaceae for the Flora of North America series, I have come to a still different view, although it is far closer to Eiten's than Lourteig's. In fact, Lourteig's biology and nomenclature appears to have been retrograde in many ways compared to Eiten's.

In the taxonomic summaries below, synonymy is representative, showing the more commonly used names and some that allude to aspects of variability within the species. Additional synonymy can be found in Eiten (1955), Lourteig (1979), and Watson (1989). Closely related taxa of the western USA are *Oxalis californica* (Abrams) R. Knuth, *O. albicans* Kunth, *O. pilosa* Nutt. ex Torr. & Gray, and *O. suksdorfii* Trel.—these

also have been treated in various taxonomic arrangements (e.g., Wiegand 1925; Lourteig 1979; Turner 1994). Useful illustrations are provided by Young (1958) and Eiten (1963).

In the present study, species are understood as taxa morphologically intergrading little or not at all with other taxa—sympatry of such taxa is taken as evidence of their reproductive isolation. With further study, beyond the scope of this overview, complexities in reproductive biology probably will show the taxonomic framework advanced here to be overly simplistic. In *Oxalis corniculata* and *O. dillenii*, populations of odd-polyploid, even-polyploid, and dysploid chromosome numbers have been reported; polyploid populations are reported in *O. stricta*. Eiten's study (1963) suggested that essentially homostylous species (*O. corniculata*, *O. dillenii*, *O. florida*, *O. stricta*) are pseudogamous apomicts when self-pollinated—pollination and pollen tube growth resulting only in endosperm fertilization. Among these, at least *O. florida* appears to be a facultative apomict—emasculated flowers producing abundant apomictic seeds and also producing sexual seeds when pollinated with acceptable pollen (Lovett Doust et al. 1981). Sexual seed production from outcrossing may occur in the other species as well. Species with strong morphological heterostyly (e.g., *O. grandis*, *O. priceae*) are consistently outcrossers. Artificial hybrids are easily produced and natural hybrids in various combinations have been identified by Eiten (1963).

The present study is based on examination of a conservatively estimated 2400 specimens (see Acknowledgements for herbaria consulted). Both Eiten and Lourteig annotated many specimens among those studied here, especially at GH, SMU, and TEX-LL, so the current author is familiar in detail with their concepts of the taxa involved. In 2009, the author has studied natural populations of sect. *Corniculatae* in Arkansas, Louisiana, Massachusetts, Missouri, Oklahoma, and Texas.

KEY TO THE YELLOW-FLOWERED CAULESCENT OXALIS SPECIES OF EASTERN NORTH AMERICA

1. Stems evenly strigose from base to peduncles and pedicels.
 2. Flowers 1 or 2–3(–5, rarely to 8) in umbelliform cymes, homostylous; petals 5–11 mm long, completely yellow, without red lines _____ **2. *Oxalis dillenii***
 2. Flowers (2–)3–5(–8) in umbelliform cymes, distylous; petals (10–)12–16(–17) mm long, yellow, with prominent red stripes at the base (corolla throat) _____ **4. *Oxalis texana***
1. Stems pilose to villous to nearly glabrous, rarely strigose and then only on peduncles or pedicels.
 3. Petals 10–20 mm long, yellow with prominent red stripes at the base (corolla throat).
 4. Stems densely and pilose with stiffly spreading nonseptate hairs; stoloniform rhizomes numerous on an individual plant and lignescent or ligneous; flowers 1 or (2–)3–8 in umbelliform cymes above the level of the leaves; corolla throats prominently red-lined within; petals 14–20 mm long _____ **3. *Oxalis priceae***
 4. Stems nearly glabrous to sparsely or densely pilose or villous with septate hairs or a mixture of septate and nonseptate hairs; stoloniform rhizomes usually 1 or few, herbaceous or lignescent; flowers 1 or 2–4(–8) in regular or irregular cymes, above or within the level of the leaves; corolla throats yellow, very faintly to strongly red-lined within; petals 10–18 mm long.
 5. Plants arising from slender, lignescent, stoloniform rhizomes without tubers; leaflets with upper shoulders usually rounded, margins often with a narrow purple margin; flowers produced above the level of the leaves; petals 10–14 mm long, throat yellow to very faintly or weakly red-lined within _____ **7. *Oxalis grandis***
 5. Plants arising from slender, herbaceous, stoloniform rhizomes at intervals producing white, horizontal, fusiform tubers or tuberlike thickenings; leaflets with upper shoulders flattened, margins green; flowers produced mostly within the level of the leaves; petals 12–18 mm long, throat strongly red-lined within _____ **8. *Oxalis illinoensis***
 3. Petals 4–9(–11) mm long, yellow, without red lines.
 6. Stems repent and radiating from taproot, rooting at most nodes; seeds brown, transverse ridges not white; stipules oblong with free marginal flanges and free distal auricles _____ **1. *Oxalis corniculata***
 6. Stems erect, usually arising singly from the base, rarely leaning and decumbent, not rooting at the nodes or rarely so; seeds all brown or with white transverse ridges; stipules obsolescent or reduced and without free margins or distal auricles.
 7. Stems 20–60(–90) cm long, sparsely to very sparsely pilose with nonseptate hairs or a mixture of nonseptate and septate hairs or densely villous with septate hairs, arising singly from the base from a short herbaceous to lignescent rhizome; flowers usually (3–)5–7(–15) in regular (rarely irregular) cymes; capsules villous to puberulent and villous to glabrate _____ **6. *Oxalis stricta***

7. Stems (5–)8–30(–35) cm, sparsely pilose with nonseptate hairs to almost completely glabrous, arising from a taproot, often producing lignescent stolons; flowers 1 or 2(–3, rarely 4–5) in umbelliform cymes; capsules glabrous to sparsely puberulent, not villous _____

5. *Oxalis florida*

1. *Oxalis corniculata* L., Sp. Pl. 1:435. 1753. *Xanthoxalis corniculata* (L.) Small, Fl. S.E. U.S. 667. 1903. TYPE: ITALY: From a wild source in Florence (“Florentia spunti,” as recorded by Burser),” Herb. Burser XVIII(2), fol. 60 (UPS-BURSER) (LECTOTYPE, Watson 1989; see Jarvis 2007: Photo in Watson 1989, p. 357, Fig. 7). The protologue notes “Habitat in Italia, Sicilia.”

Oxalis corniculata var. *atropurpurea* Planch. in Van Houtte, Fl. Serres Jard. Eur. 12:47, pl. 1205. 1857. TYPE: Lourteig 1979, pl. 205 in Van Houtte (1857).

Oxalis corniculata var. *langloisii* (Small) Wieg., Rhodora 27:121. 1925. *Oxalis langloisii* (Small) Fedde, Just’s Bot. Jahresber. 32:410. 1905. *Xanthoxalis langloisii* Small, Fl. S.E. U.S. 667, 1332. 1903. TYPE: U.S.A. LOUISIANA. St. Martin Par.: near St. Martinsville, in low woods, 15 Mar 1897, A.B. Langlois s.n. (HOLOTYPE: NY, NY digital image!).

Oxalis corniculata var. *repens* (Thunb.) Zucc., Denkschr. Koenigl. Akad. Wiss. München, ser. 2, 1:230. 1831. *Oxalis repens* Thunb., *Oxalis* 16. 1781. TYPE: Africa. Cultivated at Uppsala, Thunberg 11118 (HOLOTYPE: UPS-THUNB?).

Oxalis corniculata var. *viscidula* Wieg., Rhodora 27:121. 1925. TYPE: U.S.A. MASSACHUSETTS. Hampshire Co.: Northampton, 1902, Mrs. E.H. Terry s.n. (HOLOTYPE: GH!).

Oxalis corniculata var. *villosa* (M. Bieb.) Hohen., Bull. Soc. Imp. Naturalistes Moscou 11:395. 1838. *Oxalis villosa* M. Bieb., Fl. Taur.-Caucas. 1:355. 1808. TYPE: ALBANIA. Protologue: “Habitat in Albania ibericae lapidosis inumbratis. D. Steuen.”

Plants perennial, caulescent, arising from thin to lignescent taproots. **Stems** 4–10(–30) cm, several and radiating laterally from the taproot, creeping, rooting at the nodes and stolonlike, prostrate to distally ascending-erect, initially herbaceous but lignescent, sparsely and loosely strigose to strigose-villous. **Stipules** present, membranous, margins with free flanges, distal auricles free. **Leaves** basal and cauline; leaflets 3, obcordate, lobed 1/5–1/3 length, (4–)6–12 mm, green on both surfaces or bronze-purple to maroon, margins often prominently villous-ciliate, petioles 1–5 cm. **Flowers** 1 or 2–3(–6) in irregular or umbelliform cymes, mostly homostylous; peduncles (1–)2–4(–8) cm; pedicels in fruit horizontal to deflexed; petals 4–8 mm, yellow. **Capsules** angular-columnar, gradually or abruptly tapering to apex, 8–17(–20) mm, sparsely puberulent to glabrate or glabrous. **Seeds** uniformly brown, transverse ridges brown. $2n = 24, 36, 42, 44, 48$.

Flowering Mar–Aug, sporadically all year in Florida. Gardens, greenhouses, lawns, fields, roadsides, hammocks, beach margins, open pine woods, grasslands; 10–500(–2500) m; Nfld.!, Ont.!, P.E.I.!, Ala.!, Ark.!, Calif.!, Colo.!, Conn.!, D.C.!, Fla.!, Ill.!, Ind. (fide Kay Yatskievych), La.!, Me.!, Mass.!, Mo.!, N.J.!, N.C.!, Oreg.!, Pa.!, S.C.!, Tex.!, Vt.!, Va.!, W.Va.!, introduced; native to Mexico, West Indies, Central America, South America; introduced Europe, Asia (India, China, Japan), Africa, Pacific Islands, Australia. The PLANTS Database shows records for Ariz., Ga., Nebr., Ohio, Okla., S.Dak., and Wash.

Many infraspecific taxa of *Oxalis corniculata* in the broad sense have been described over its cosmopolitan range, but their taxonomic status is uncertain and only the single entity is treated here. The reported variation in ploidy level is a concomitant of the complex morphological variation.

Oxalis corniculata in the USA is recognized by its relatively small flowers, sparsely hairy stems creeping and rooting at nodes, all procumbent and radiating from the taproot, and its well-developed stipules with broad, free marginal flanges and auricled apices. Peduncles and 1 or 2–3 leaves are produced at the nodes, short erect stems rarely. Plants flower as annuals but often become short-lived perennials through the colonial habit. Stems of *O. dillenii* sensu stricto may be decumbent or prostrate and rooting at the nodes, but they almost always are ligneous to lignescent, not evidently radiating from the taproot, and erect stems characteristically arise from the nodes. According to Eiten (1963), *O. dillenii* is able to form “vigorous, floriferous, but sterile hybrids with *O. corniculata*.”

Plants of *Oxalis corniculata* with bronze-purple to maroon leaves and pubescent capsules have been recognized as *O. corniculata* var. *atropurpurea* (e.g., in Florida, Ward 2004; in California, Abrams 1951). Such plants apparently occur sympatrically with the typical expression and it is not clear whether they are populational variants or whether they are at least partially reproductively isolated. In Malaysia, var. *atropurpurea* differs from typical *O. corniculata* in karyotype as well as in floral and vegetative morphology and is isolated by post-pollination reproductive barriers (Nair & Kuriachan 2004)—at least in that region its biological behavior indicates that var. *atropurpurea* should be treated at specific rank. Distinctive Australasian vari-

ants sometimes identified as *O. corniculata* have recently been treated as distinct species (e.g., de Lange et al. 2005). A form of *O. corniculata* is common in central Mexico (collections seen from Hidalgo, Jalisco, Edo. Mexico, Michoacan, Morelos, and Querétaro)—these plants produce large, prominent stipules and nearly glabrous stems, but the habit varies from procumbent to ascending and the stems rarely root at the nodes.

Most of the closest relatives of *Oxalis corniculata* (in its American expression) occur in the Americas and West Indies and the species probably is native there, though probably south of the United States. In the USA, *O. corniculata* occurs mostly in urban and highly disturbed habitats, but along the Gulf coast it occasionally grows in less obviously disturbed sites. North of the Gulf Coast, its occurrence is mostly restricted to greenhouses and horticultural sites (lawns and gardens), suggesting that it is repeatedly introduced rather than persisting (and expanding) through seed production.

2. *Oxalis dillenii* Jacq., *Oxalis* Mon. 28. 1794. *Oxalis corniculata* L. var. *dillenii* (Jacq.) Trel. in A. Gray, Syn. Fl. N. Amer. 1(1):365. 1897. *Xanthoxalis dillenii* (Jacq.) Holub, Bot. Közlem. 59:38. 1972. TYPE: Jacquín noted in the protologue “Plantam non vidi. Omnia ex Dillenio desumpsi” (Plant not seen. It is entirely selected from Dillenius), thus the name is based on the description and illustration by Dillenius in Hortus Elthamensis 2: f. 298, t. 221. 1732. The plant illustrated probably was raised from seed from a collection made by Mark Catesby, as Sherard and Dillenius had received nearly a full set of Catesby’s specimens from eastern North America (Reveal 1983). It apparently is the specimen in Dillenius’s herbarium under his phrase-name “Oxys lutea americana, humilior et annua,” *Dillenius s.n.* (HOLOTYPE: OXF).

Eiten (1955, p. 104) observed that “Although the original Dillenius plate is distinctive, there is also a plant in the Hortus Elthamensis herbarium which is almost surely the plant Dillenius used (Druce & Vines 1907, p. 176), and therefore, if unique, is the holotype.” Watson (1989, p. 361) also noted that “the Dillenian reference must be considered for holotype material, since his was the only cited work [i.e., cited by Jacquín].” Lourteig (1979) cited “TIPO: America, Hort. Elth. OXF”

Oxalis dillenii var. *radicans* Shinnery, Field & Lab. 24:39. 1956. TYPE: U.S.A. TEXAS. Freestone Co.: 4.8 mi SSE of Streetman, 28 Apr 1956, L.H. Shinnery 23872 (HOLOTYPE: SMU!; ISOTYPE: GH-2 sheets!).

Oxalis lyonii Pursh, Fl. Amer. Sept. 1:322. 1814 [1813]. *Oxalis corniculata* L. var. *lyonii* (Pursh) Zucc., Denkschr. Königl. Akad. Wiss. München ser. 2, 1: 230. 1831. TYPE: U.S.A. GEORGIA. [Camden Co.]: Cumberland Island, Jun [ca. 1800-1813], John Lyon s.n. (herb. Lyon, lost or destroyed, fide Ewan & Ewan 1963). NEOTYPE, designated here: Florida. [Duval Co.]: Near Jacksonville, “188-”, A.H. Curtiss s.n. (NCU 69362, digital image!). Curtiss made collections from “near Jacksonville” at least in 1893, 1894, 1896, 1897, and 1898; the NCU sheet has only “188” printed, lacking the last digit of the date. Jacksonville, in Duval Co., Fla., is very close to Camden Co., Ga., separated only by about 25 mi, mostly in Nassau Co. Fla.

The neotype designated here replaces the one designated by Lourteig (1979), a collection selected from southern Mississippi, in conflict with Pursh’s protologue—which unambiguously places the type locality in southeastern Georgia (see comments by Ward 2004)—and intended by Lourteig to represent a species (*O. texana*, as identified here) restricted to eastern Texas, southern Arkansas, and west and central Louisiana. Lourteig’s selection is from Mississippi (Harrison Co.: Henderson Point, 18 Mar 1954, Demaree 34767-GH!; duplicate: USF) and is a plant of *O. dillenii* (as noted by Eiten 1963 and as annotated by him in 1965; confirmed as *O. dillenii* in the present study, 2009), out of geographical range for *O. texana*.

Oxalis recurva Ell. var. *floridana* Wieg., Rhodora 27:138. 1925. TYPE: U.S.A. FLORIDA: East Florida, no date, D.C. Eaton s.n. (HOLOTYPE: GH!).

Oxalis stricta var. *piletocarpa* Wieg., Rhodora 27:123. 1925. TYPE: U.S.A. NEW HAMPSHIRE. [Cheshire Co.]: Alstead, old gravel pit, 1901, E.F. Williams (HOLOTYPE: GH!).

Plants perennial, caulescent, arising from a ligneous or lignescent rhizome, sometimes appearing taproot-like. **Stems** 10–25 cm, proximally ligneous to lignescent, 1.5–2 mm thick, usually 2–8 from the base, erect initially, often becoming decumbent to prostrate and rhizome-like, sometimes rooting at nodes, strigillose to strigose with antrorsely appressed, nonseptate, sharp-pointed hairs. **Stipules** usually greatly reduced at least above midstem, margins narrowly flanged or without any free portion, without free apical auricles. **Leaves** basal and cauline; leaflets 3, obcordate, lobed 1/5–1/3 length, (4–)6–15(–21) mm, green on both surfaces, glabrous adaxially, sparsely strigillose abaxially, petioles 1–4 cm. **Flowers** 1 or 2–3(–4, very rarely to 8) in umbelliform (rarely irregular) cymes, mostly homostylous; peduncles 1–6(–10) cm; pedicels in fruit deflexed (to horizontal), usually without bracteoles; petals 5–11 mm, yellow. **Capsules** angular-columnar, abruptly tapered at apex, 12–20(–25) mm, densely strigose-pilose with mixture of appressed and spreading hairs, with a puberulent understory. **Seeds** brownish, transverse ridges with strong grayish or white lines. $2n = 18, 20, 22, 20–24$.

Flowering Feb–May(–Oct). Pastures, roadsides, lawns, river bottoms, sandy, rocky, or gravelly soils;

5–300 m; N.B., N.S., Ont., P.E.I., Que., Sask.; Ala., Ark., Ariz., Colo., Conn., Del., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Mass., Mich., Minn., Miss., Mo., Nebr., N.H., N.J., N.Mex., N.Y., N.C., N.Dak., Ohio, Okla., Pa., R.I., S.C., S.Dak., Tenn., Tex., Va., Vt., Wash., W.Va., Wis., Wyo.; introduced in Bermuda, Europe. The PLANTS Database shows records from Alta, Man., Idaho, and Oreg.

Decumbent branches of *Oxalis dillenii* often appear as stoloniform, producing erect branches and leaves at the nodes, rarely producing a few, small adventitious roots. Such plants sometimes are misidentified as *O. corniculata*, but they differ in their overall habit, ligneous stems and rhizomes, reduced stipules, strigillose cauline vestiture, denser fruit vestiture, and seed color. In *O. dillenii*, the stems are consistently strigose, while the long petioles commonly are pilose-villous, and in a quick scan of a specimen not carefully pressed, stem vestiture might be misinterpreted.

Oxalis dillenii may continue to flower, or begin to reflower, in moist places especially in the fall. Plants are often abundant in lawns and other mowed areas, and later-flowering plants commonly produce very small flowers. The species shows much plasticity in habit, some of which may be genetically partitioned, as dysploid chromosome races apparently exist.

Oxalis dillenii and *O. stricta* are the two most abundant species of the eastern United States and both commonly occur in disturbed sites. In view of recent nomenclatural confusion (see comments below, under *O. stricta*), a key that separates these two is presented here.

1. Stems usually 2–8 from the base, 10–25 cm, erect initially, often becoming decumbent to prostrate and rhizome-like, sometimes rooting at nodes; stem vestiture strigose to strigillose from base to peduncles and pedicels with antrorsely appressed, nonseptate, sharp-pointed hairs; plants arising from a taproot, producing ligneous or lignescent rhizomes or stolons; flowers 1 or 2–3(–5, rarely to 8) in umbelliform cymes _____ **Oxalis dillenii**
1. Stems usually arising singly from the base (rarely 2–3 together), 20–60(–90) cm, erect or later leaning or falling over and decumbent; stem vestiture very sparsely to sparsely or moderately pilose or villous with nonseptate hairs or a mixture of nonseptate and septate hairs **or** densely villous with septate hairs; plants arising from a thin, short herbaceous to lignescent rhizome; flowers usually (3–)5–7(–15) in regular (rarely irregular) cymes _____ **Oxalis stricta**

3. *Oxalis priceae* Small, Bull. Torrey Bot. Club 25:612. 1898. *Xanthoxalis priceae* (Small) Small, Fl. S.E. U.S. 668. 1903.

TYPE: U.S.A. KENTUCKY. Warren Co.: Bowling Green, rocky hillsides, open woods, fields, and roadsides, 6 Nov 1898, *S.F. Price s.n.* (LECTOTYPE, Eiten 1963: NY, NY-digital image!).

Oxalis caespitosa Raf., New Fl. N. Amer. 2:27. 1838 (non *O. caespitosa* A. St. Hil. 1825). TYPE: U.S.A. KENTUCKY: glades of West Kentucky and Tennessee, May–Jun 1823, *C.S. Rafinesque s.n.* (LECTOTYPE, Lourteig 1979: P).

Oxalis macrantha (Trel.) Small, Fl. S.E. U.S. 667. 1903. *Oxalis corniculata* L. var. *macrantha* Trel., Mem. Boston Soc. Nat. Hist. 4:88, pl. 11, fig. 5. 1888. *Oxalis recurva* Ell. var. *macrantha* (Trel.) Wieg., Rhodora 27:138. 1925. TYPE: U.S.A. ALABAMA. Alabama, no date, *P. Hatch s.n.* (LECTOTYPE, Lourteig 1979: GH!).

Oxalis hirsuticaulis Small, Bull. Torrey Bot. Club 25:611. 1898. TYPE: U.S.A. TENNESSEE. Davidson Co.: Nashville, [no date], *A. Gattinger s.n.* (HOLOTYPE: NY, NY-digital image!). *Oxalis hirsuticaulis* was published in the same article as *O. priceae*—adoption of the latter here follows Eiten's original choice in 1955.

Oxalis recurva Ell. var. *macrantha* (Trel.) Wieg. forma *sericea* Wieg., Rhodora 27:138. 1925. TYPE: U.S.A. ALABAMA: no other data, *Dr. Cabell s.n.* (HOLOTYPE: GH!).

Xanthoxalis colorea Small, Fl. S.E. U.S. 668, 1333. 1903. *Oxalis priceae* subsp. *colorea* (Small) Eiten, Amer. Midl. Naturalist 69:302. 1963. TYPE: U.S.A. GEORGIA. DeKalb Co.: On and about Stone Mt., 100–1500 ft, 1–16 May 1895, *J.K. Small s.n.* (HOLOTYPE: NY, NY-digital image!; ISOTYPES: F, NY, NY-digital image!).

Plants perennial, caulescent, arising from a ligneous or lignescent taproot, usually with lignescent, stoloniform (or offset-like) rhizomes rooting at nodes and producing erect stems from the nodes. **Stems** proximally lignescent, usually 2–8 from the base, 5–20(–40) cm, erect or usually becoming decumbent, villous-hirsute with nonseptate hairs spreading or deflexed or spreading in dissimilar orientations. **Stipules** with margins narrowly flanged or without any free portion, without free apical auricles. **Leaves** basal and cauline; leaflets 3, obcordate, lobed 1/5–1/3 length, 3.5–12 mm, green on both surfaces, strigose-hirsute on both surfaces, less commonly glabrate, petioles 2–7 cm. **Flowers** 1 or (2–)3–8 in umbelliform cymes, less commonly irregular cymes, produced well above the level of the leaves, distylous; peduncles (3–)5–10(–15) cm; pedicels in fruit

deflexed to horizontal, often bracteolate; petals (13–)14–20 mm, yellow, with prominent red stripes at the base (corolla throat). **Capsules** angular-cylindric, abruptly tapered at apex, 10–15 mm, sparsely to densely villous with long, deflexed, nonseptate hairs, less commonly puberulent with short, straight, deflexed hairs. **Seeds** usually with white transverse ridges. $2n =$ unknown.

Flowering Mar–May. Dry limestone areas, glades, cedar barrens, chalk prairies, limestone bluffs and outcrops, sandstone cliffs, rocky slopes, talus, sandy hedgerows, oak-pine, longleaf pine; 5–300 m; Ala.!, Fla.!, Ga.!, Ky.!, Miss.!, N.C.!, S.C.?, Tenn.!, Mexico (Nuevo León!).

Oxalis priceae is a distinctive species of the southeastern USA, recognized by its villous to villous-hirsute stems, flowers in umbelliform cymes, and large yellow to yellow-orange corollas with red lines in the throat. The lines in the throat remain visible after drying and usually can be seen on herbarium specimens even from the outside of the flower. A similar pattern also occurs in *O. texana*, *O. illinoensis*, and *O. grandis*.

Plants of *Oxalis priceae* in Mississippi and eastern Louisiana grow in pineland and have slightly smaller corollas than those eastward. Vouchers for Louisiana records are cited here. Jefferson Par.: at Gretna, opposite New Orleans, 6 May 1899, *Ball* 352 (GH); Rapides Par.: Red River valley, near Zimmerman RR Sta., frequent in dryer spots beneath tall pines on crest of hills, 24 Apr 1948, *Ewan* 17608 (MO); St. Tammany Par.: 5 mi S of Pearl River, US 90, hwy embankment, 30 Apr 1953, *Ewan* 18546 (GH).

Two collections from a single area in North Carolina are typical *Oxalis priceae*, at the northeastern extremity of its main range. Stanly Co.: rocky slopes below bluffs of Yadkin River, near Charlotte, 20 Apr 1932, *Palmer* 39985 (GH); steep moist banks above the Yadkin River, just above the second or lower power dam east of Badin, 10 May 1963, *Wilbur* 6826 (GH). Similarly, a collection of *Oxalis priceae* from eastern Tennessee appears to be disjunct. Cocke Co.: near Del Rio, siliceous bluffs along Newport Rd., 18 Apr 1963, *Sharp et al.* 17255 (TENN digital image!). Further study may fill in the known distribution, especially in Georgia and South Carolina, so that the Cocke Co. and Stanly Co. localities no longer appear disjunct.

Two collections from montane Nuevo León, Mexico, are unmistakably *Oxalis priceae*, disjunct from the closest localities in the southeastern USA by about 900 kilometers. Nuevo León. Mpio. Santiago, along the Cola de Caballo-Laguna Sanchez road into high sierra SE of Monterrey, between Puerto Genovevo and La Cienega, ca. 1.5–2.5 air km NW of Puerto Genovevo, temperate pine-oak-hickory dominated by *Pinus*, *Carya ovata*, 1500 m, 15 Mar 1994, *Mayfield* 1887 (TEX); Mpio. Bustamante, along switchbacks of road below the Grutas de Bustamante, ravines and bluffs along road from opening of cave to ca. 4 road km below cave, *Quercus-Cercis-Brahea-Ungnadia-Fraxinus greggii*, dark, rich, rocky soil in talus slopes, 1000 m, fairly common in moist ravine to E of cave opening, 18 Mar 1994, *Mayfield* 1908 (TEX).

4. *Oxalis texana* (Small) Fedde, *Just's Bot. Jahresber.* 32:410. 1905. *Xanthoxalis texana* Small, *Fl. S.E. U.S.* 667, 1332. 1903. *Oxalis recurva* Ell. var. *texana* (Small) Wieg., *Rhodora* 27: 138. 1925. *Oxalis priceae* Small subsp. *texana* (Small) Eiten, *Amer. Midl. Naturalist* 69:301. 1963. TYPE: U.S.A. TEXAS. Brazoria Co.: Alvin, 20 Apr 1894, *E.N. Plank* s.n. (HOLOTYPE: NY, NY-digital image!).

Plants perennial, caulescent, arising from a woody taproot, caespitose with stems arising from a caudex or with rhizome-like offsets or stolons rooting at the nodes. **Stems** 5–15 cm, proximally liginous to lignescent, erect to ascending, strigose to strigillose with antrorsely appressed to ascending nonseptate hairs. **Stipules** usually with margins very narrowly flanged, usually with rounded and slightly free apical auricles. **Leaves** basal and cauline, leaflets 3, cordate, lobed 1/5–1/3 the length, (4–)6–12(–18) mm long, green to purple on both surfaces, glabrous to sparsely strigose adaxially, sparsely strigose abaxially; petioles 2–6 cm long. **Flowers** (2–)3–5(–8) in umbelliform cymes, very rarely irregular cymes, distylous, peduncles 4–10 cm; pedicels horizontal to deflexed in fruit, without bracteoles; petals (10–)12–16(–17) mm long, yellow, with prominent red lines at the base (corolla throat). **Capsules** angular-columnar, abruptly tapered at apex, 8–15 mm long, moderately to densely puberulent to puberulent-villous. **Seeds** brownish, transverse ridges distinctly whitish. $2n =$ unknown.

Flowering Mar–May(–Jun). Commonly in undisturbed habitats and usually in deep, loose sand, but also fields, roadsides, and edges and openings in woods, pine, pine-oak, and mixed hardwoods; 10–200 m; Ark.!, La.!, Tex.!

Oxalis texana is very similar to *O. dillenii*—differing from *O. dillenii* primarily in its more numerous flowers per inflorescence and larger, distylous flowers with red-lined corolla throats. The distinctive red striping in the corolla throat remains visible after drying and usually can be seen on herbarium specimens even from the outside of the flower. Plants of *O. texana* also are distinct in their relatively larger taproots and habit either caespitose or with short stolon-like offsets. Plants of *O. dillenii* with larger flowers on elevated peduncles might be mistaken for *O. texana*, yet the two taxa exist sympatrically in the range of *O. texana* and it seems clear that they are separate species. *Oxalis priceae* and *O. texana* are separate in geography and morphology.

Lourteig (1979) used the name *Oxalis lyonii* Pursh for the species identified here as *O. texana*, and her illustrations of *O. lyonii* were drawn from a Texas collection identified here as *O. texana* (Lourteig 1979, Fig. 7, a-e). Turner et al. (2003) followed Lourteig's nomenclature and mapped the same species as *O. lyonii*. Lourteig neotypified *O. lyonii* to place it within her concept of *O. texana* (as identified here) and included *O. [Xanthoxalis] texana* in synonymy—her neotype, however, is from southern Mississippi, outside of the range of *O. texana*, and is instead a collection of *O. dillenii* (as noted by Eiten 1963 and annotated by him in 1965; confirmed here as *O. dillenii*). Further comments regarding *O. lyonii* are in the synonymy of *O. dillenii* in the present paper.

5. *Oxalis florida* Salisb., Prodr. Stirp. Chap. Allerton, 322. 1796. TYPE: from seeds from South Carolina, probably collected by John Fraser, cultivated in Hortus Chapel Allerton, 1789, *Salisbury s.n.* (HOLOTYPE: BM; ISOTYPE: G-DC). Fide Lourteig 1979.

Oxalis brittoniae Small, N. Amer. Fl. 25:52. 1907. TYPE: U.S.A. NEW YORK. Richmond Co.: Giffords, Staten Island, 19 May 1889, *N.L. Britton s.n.* (HOLOTYPE: NY, NY-digital image!).

Oxalis filipes Small in Britton & Brown, Ill. Fl. N. U.S. 2:346. 1897. *Oxalis florida* Salisb. var. *filipes* (Small) Ahles, J. Elisha Mitchell Sci. Soc. 88:172. 1964. *Xanthoxalis filipes* (Small) Small, Fl. S.E. U.S. 667. 1903. *Oxalis dillenii* Jacq. subsp. *filipes* (Small) Eiten, Amer. Midl. Naturalist 69:301. 1963. TYPE: U.S.A. NORTH CAROLINA. Stanley Co.: Falls of the Yadkin River, 100–200 ft, 23 Aug 1894, *J.K. Small 61* (LECTOTYPE, Eiten 1963: NY, NY-digital image!; DUPLICATES OF THE LECTOTYPE: F, MO!, MSC, NY, NY-digital image!).

Oxalis prostrata Haworth, Misc. Natur. 183. 1803. *Oxalis florida* Salisb. subsp. *prostrata* (Haworth) Lourteig, Phytologia 42:156. 1979. TYPE: USA, cultivated in England, *Haworth s.n.* (destroyed). TYPE: U.S.A. VIRGINIA. Henrico Co.: dry cinders of RR embankment W of Elk Station, 21 Oct 1938, *M.L. Fernald and B. Long 9355* (NEOTYPE, Lourteig 1979:US, US-digital image!; ISONEOTYPE: GH!). Lourteig cited the collection date as 21 Sep 1928.

Oxalis recurva Ell., Sketch Bot. S.C. 1:526. 1821. *Oxalis florida* Salisb. var. *recurva* (Ell.) Ahles, J. Elisha Mitchell Sci. Soc. 80:173. 1964. *Oxalis dillenii* Jacq. subsp. *recurva* (Ell.) C.F. Reed, Phytologia 63:411. 1987. TYPE: U.S.A. SOUTH CAROLINA: In cultis at pascuis circa Charleston, Apr, *Elliott s.n.* (CHARL, photo-GH!). Eiten (1963) noted that the type specimen, lacking flowers, of *O. recurva* has habit and stem vestiture that would place it with equal probability as either *O. priceae* [subsp. *priceae*] or *O. florida*. Geography places it with the latter, though Eiten chose to keep it as a “nomen dubium.” Elliott's protologue noted “Very common near Charleston, intermingled with the *O. stricta*, with which it has been confounded.”

Oxalis rupestris Raf., New Fl. N. Amer. 2:26. 1838 (non *O. rupestris* A. St. Hil. 1825). TYPE: U.S.A. KENTUCKY: Kentucky, 1823?, *Rafinesque s.n.* (LECTOTYPE, Lourteig 1979:P).

Plants perennial, caulescent, arising from slender lignescent stolons, youngest plants from short, slender taproots. **Stems** usually single from the base, (5–)8–30(–35) cm, erect or rarely leaning and decumbent, subglabrous to sparsely to moderately pilose-villous with very fine hairs spreading in irregular orientation, sometimes strigose distally or just beneath the flowers and pilose-villous on proximal portions. **Stipules** obsolescent, without free margins or apical auricles. **Leaves** basal and cauline, leaflets 3, obcordate, lobed 1/5–1/3 length, 4–11 mm long, green on both surfaces, sparsely strigose abaxially; petioles 2–5 cm. **Flowers** 1 or 2(–3, rarely 4–6) in umbelliform cymes at level of the leaves or slightly above, tristylous; peduncles (2–)3–8 cm; pedicels reflexing to ascending, often bracteolate; petals 5–9(–11) mm, yellow. **Capsules** angular-cylindric, 8–12(–15) mm, glabrous to sparsely puberulent. **Seeds** brownish, including transverse ridges. $2n = 16$.

Flowering Mar–May(–Aug). Low woods, swamp forests, rich woods, pine woods, sandy sites, burned-over woods, ditches, roadside banks, floodplains, low fields, lake edges, creek banks, pastures, disturbed sites, bluffs, rocky slopes; 10–350 m; Ala.!, Ark.!, Conn.!, D.C.!, Fla.!, Ga.!, Ind. (fide Kay Yatskievych), Ky.!, La.!, Maine!, Md.!, Mass.!, Miss.!, Mo.!, N.J.!, N.Y.!, N.C.!, Pa.!, S.C.!, Tenn.!, Vt.!, Va.!, W.Va.!

Oxalis florida is recognized by its mostly erect stems, sparse and spreading cauline vestiture without multicellular hairs, obsolescent stipules, relatively small, and yellow flowers without red lines in the throat; the distal stems and peduncles are thin compared to other species. It is a species primarily of the Atlantic states and Gulf coast, much more sparsely represented in more inland regions. It is known from a cluster of counties in southeastern Missouri (Butler, Carter, Ripley, and Wayne cos.; MO!), and from southern Arkansas (Ashley, Bradley, and Ouachita cos.; BRIT!, NLU!) northward to apparently isolated localities in Arkansas (e.g., Yell Co.; MO!). The voucher for the West Virginia record perhaps was a waif—Tucker Co.: Otter Creek Lumber Co., near Hendriks, dry grounds along railroad track, 10 Sep 1904, *Greenman 400* (GH). A collection annotated by Eiten as *O. dillenii* var. *filipes* is interpreted here as *O. dillenii* with slightly reduced vestiture, perhaps resulting from damaged stems: Polk Co: 12 Apr 1941, *Tharp s.n.* (GH).

Lourteig (1979) also treated *Oxalis florida* at specific rank, and for Florida, Ward (2004, p. 35) noted that “the differences between *O. dillenii* subsp. *dillenii* and subsp. *filipes* (= *O. florida*) “are appreciable and intermediates seem few.” In contrast, Eiten (1963, p. 268) observed that *Oxalis dillenii* subsp. *filipes* “is distinctive in its most characteristic form but intergrades with [subsp. *dillenii*], both in forming intermediate homogeneous populations and also, in disturbed ground, variable hybrid swarms. The most distinctive portion of this variable subspecies is concentrated in the northern Appalachians. The morphological evidence is conflicting as to whether it originated from [subsp. *dillenii*] or directly from [*O.*] *corniculata*.”

Wiegand (1925, p. 124), preceding Eiten, also observed a measure of intermediacy in *Oxalis florida*, noting that “*O. florida* and *O. filipes* have much the appearance of hybrids between [*O. stricta* and either *O. dillenii* or *O. corniculata*], as no new characters are found in either species. The frequency of their occurrence in the east and absence in the west, where the possible parents both occur is against this hypothesis.”

Ward (2004, p. 35) noted that Eiten was incorrect in claiming that the name *Oxalis florida* Salisb. is illegitimate. “The name [phrase-name] cited in synonymy by Salisbury (1796) was pre-Linnaean which, since not available for his use, does not disturb the legitimacy of *O. florida*.”

In Eiten’s view (1963), the difference between *Oxalis dillenii* subsp. *filipes* and *O. priceae* subsp. *colorea* was primarily in flower size. Subsp. *filipes* keyed under “Flowers 13 mm long or less,” while subsp. *colorea* keyed under “Flowers 10 mm long or more.” The seemingly arbitrary difference in size apparently is reflected in his comment that he identified a duplicate (F) of the type of *Xanthoxalis colorea* as *O. dillenii* subsp. *filipes*.

In the current study, I have sorted collections previously identified as *Oxalis priceae* subsp. *colorea* mostly between *O. florida* and *O. priceae*, and the reality of subsp. *colorea* remains somewhat in doubt, even though it is placed here as a synonym of *O. priceae*. Mulcahy (1964, p. 1048) found that both *O. priceae* sensu stricto and *O. priceae* subsp. *colorea* exhibit a high degree of self-fertility, the former strictly distylous, the latter tristylous. “A further difference between the 2 subspecies is that subspecies *priceae* forms very dense and extensive clones, some of which extend for several meters, while subspecies *colorea* forms rather diminutive clones, very few of which contain more than 3–4 flowering stalks.” Ward did not find significant variation within *O. priceae*, listing *Xanthoxalis colorea* as a synonym.

6. *Oxalis stricta* L., Sp. Pl. 1:435. 1753. TYPE: Morison, Pl. Hist. Univ. 2:184, s. 2, t. 17, fig. 3. 1680 (LECTOTYPE: Eiten 1955).

The protologue noted “Habitat in Virginia.”

Lourteig (1979) identified this species as *Oxalis fontana*, typified by a plant from northern China, and applied the name *O. stricta* to the species identified by Eiten (1955, 1963) and here as *O. dillenii*. The basis for the difference lies in selection of lectotypes for *O. stricta*. Lourteig (1979), and earlier Robinson (1906), opined that Linnaeus worked with Gronovius and was most likely to have been familiar with a John Clayton specimen in the Gronovius collection (*Clayton 474*, BM, photo-GH!, BM-Clayton-digital image!)—this plant identified here as *O. dillenii*. Eiten (1955), followed by Jarvis (2007), noted that selection of a Morison illustration as lectotype of *O. stricta* best characterizes the species long-naturalized and weedy in Europe and probably known first-hand by Linnaeus. The situation has been excellently summarized by Ward (2004).

Oxalis bushii Small, Bull. Torrey Bot. Club 25:611. 1898. *Oxalis europaea* var. *bushii* (Small) Wieg., Rhodora 27:135. 1925. *Oxalis stricta* var. *bushii* (Small) Farwell, Mich. Acad. Sci. Rep. 20:183. 1918. *Oxalis fontana* var. *bushii* (Small) H. Hara, J. Jap. Bot. 24:106. 1949. TYPE: U.S.A. MISSOURI. Jackson Co.: NW Jackson Co., dry ground, 28 May 1893, *B.F. Bush 30* (HOLOTYPE: NY, NY-digital image!; ISOTYPE: GH!).

Oxalis coloradensis Rydb., Bull. Torrey Bot. Club 29:243. 1902. TYPE: U.S.A. COLORADO. Larimer Co.: Sangre de Christo Creek, 2400–2700

m, 2 Jul 1900, P.A. Rydberg 5920 with F.K. Vreeland (HOLOTYPE: NY, NY-digital image!; ISOTYPE: NY, NY-digital image!).

Oxalis cymosa Small, Bull. Torrey Bot. Club 23:267. 1896. *Oxalis europaea* forma *cymosa* (Small) Wieg., Rhodora 27:135. 1925. TYPE: U.S.A. NEW YORK. [Bronx Co.]: Riverdale, 26 Aug 1894, E.P. Bicknell s.n. (possible HOLOTYPE: NY, NY-digital image!).

Oxalis europaea Jordan in F. Schultz, Arch. Fl. France Allemagne 309. 1854. TYPE: Apparently no type exists for this name. Jordan reckoned that the European plants were not the same species as the American ones identified as *Oxalis stricta* L. and because Linnaeus had indicated that *O. stricta* is uniquely American, he provided a new name for the European ones. He noted that the species “est si commune in beaucoup des localités, et on la trouve si loin des lieux habités, qu’il est fort difficile d’admettre qu’elle nous soit venue d’Amérique et ne soit pas réellement une espèce indigène.” There was no more specific indication of any potential type or types than this. Neither Wiegand (1925), Eiten (1955), nor Lourteig (1979) provided any information on the typification of *O. europaea*.

Wiegand (1927, p. 136) noted that “*O. europaea* is with little doubt a native of America, but was introduced into Europe about 1658. It seems to have been cultivated by Morison in 1660 and was figured by him in his Historia. An outline of the early history of this species is given by Ascherson and Graebner [1913, Vol. 7:149].”

Oxalis europaea Jordan forma *pilosella* Wieg., Rhodora 27:135. 1925. TYPE: U.S.A. MISSOURI. Jackson Co.: Courtney [Greenwood], 20 May 1912, B.F. Bush 6701 (HOLOTYPE: GH!; ISOTYPES: NY, US, US-digital image!).

Oxalis europaea Jordan forma *subglabrata* Wieg., Rhodora 27:136. 1925. TYPE: USA. Iowa. [Story Co.]: Ames, Pammel and Ball 4 (HOLOTYPE: GH!; ISOTYPE: MO!, MO-digital image!, US, US-digital image!).

Oxalis europaea Jordan forma *vestita* Wieg., Rhodora 27:136. 1925. TYPE: U.S.A. MASSACHUSETTS. [Middlesex Co.]: Cambridge, 1904, Miss I.W. Anderson s.n. (HOLOTYPE: GH!).

Oxalis europaea Jordan forma *villicaulis* Wieg., Rhodora 27:135. 1925. *Oxalis stricta* var. *villicaulis* (Wieg.) Farwell, Amer. Midl. Naturalist 11:62. 1928. TYPE: USA. Michigan. [St. Clair Co.]: Port Huron, 1914, C.K. Dodge 41 (HOLOTYPE: GH!).

Oxalis fontana Bunge, Enum. Pl. China Bor. 13. 1833. TYPE: CHINA: “Borealis, Pan-Sham, hab. ad fontam,” 1831, A.A. Bunge s.n. (HOLOTYPE: P; ISOTYPES: E, P). Fide Lourteig (1979).

Oxalis interior (Small) Fedde, Just’s Bot. Jahresber. 32:410. 1905. *Xanthoxalis interior* Small, Fl. S.E. U.S., 668. 1903. TYPE: U.S.A. ARKANSAS. Benton Co.: no other locality data, 1899, E.N. Plank s.n. (LECTOTYPE, Eiten 1955:NY, NY-digital image!; ISOLECTOTYPE: NY, NY-digital image!).

Plants annual to short-lived perennial, caulescent, arising from a thin, short rhizome. **Stems** usually arising singly from the base (rarely 2–3 together), erect or later leaning or falling over and decumbent, 20–60(–90) cm, villous with nonseptate hairs, spreading septate hairs present on stems and petioles, commonly concentrated at nodes, sometimes only on petioles. **Stipules** obsolescent, without free margins or apical auricles. **Leaves** basal and cauline; leaflets 3, obcordate, lobed 1/5–1/3 length, (8–)10–20(–30) mm, light green to yellowish-green on both surfaces, petioles 2–8 cm. **Flowers** rarely 1 usually (3–)5–7(–15) in regular cymes, less commonly in irregular cymes, usually within level of the leaves or slightly above, homostylous or slightly to strongly heterostylous; peduncles 3–9(–11) cm; pedicels in fruit erect to ascending, often bracteolate; petals (6–)8–11 mm, yellow. **Capsules** columnar, nearly terete, abruptly tapering toward apex, 8–15 mm, villous with septate hairs to glabrate. **Seeds** brown, transverse ridges rarely whitish. $2n = 18, 24$.

Flowering (Apr–)Jul–Oct. Prairie ravines, river and stream banks, sand bars, low woods, floodplains, roadsides, fields, lawns, gardens; 20–1200 m; B.C., Man., N.B.!, Nfld., N.S.!, Ont.!, P.E.I.!, Que.!, Ala.!, Ark.!, Colo.!, Conn.!, Del.!, D.C.!, Ga.!, Idaho, Ill.!, Ind.!, Iowa!, Kans.!, Ky.!, La.!, Maine!, Mass.!, Md.!, Mich.!, Minn.!, Miss.!, Mo.!, Nebr.!, N.H.!, N.J.!, N.Y.!, N.C.!, N.Dak.!, Ohio!, Okla.!, Pa.!, R.I.!, S.C.!, S.Dak.!, Tenn.!, Va.!, Vt.!, W.Va.!, Wis.!, introduced in Europe, Asia, Africa, Pacific Islands (New Zealand), Australia. The PLANTS Database shows records from Nfld., Sask., Ariz., Mont., N.Mex., Wash., and Wyo.

Oxalis stricta is recognized by its tall, erect stems from a short, simple rhizome, presence of septate hairs, cymose inflorescence, and relatively small flowers. Septate hairs on the stems and petioles are easily recognized (lens), especially because of their brownish crosswalls, but they vary greatly in density, as do the nonseptate hairs. In “villicaulis” and “pilosella” forms, as well as “var.” bushii, the septate hairs are dense and evenly distributed on the stems, but more often they are localized around the nodes and intermixed with nonseptate hairs. Often they are few in number, and, in rare cases, plants with greatly reduced vestiture overall apparently lack septate hairs.

The rhizomatous habit, lacking taproots, of *Oxalis stricta* and its close relatives *O. grandis* and *O. illinoensis* is distinctive and a basic biological difference. The bases of *Oxalis* plants often are incompletely collected, however, especially in the other species, which commonly develop stoloniform or rhizomiform branches above the taproot.

Oxalis stricta in western states is uncommon and probably adventive. Reports of the species from Texas

(e.g., USDA, NRCS 2009) have not been confirmed in the present study and it is unlikely that such reports are accurate. The early establishment of *O. stricta* in Europe is noted above with the type of *O. europaea*. Eiten (1963) appeared to suggest that the species may be native in eastern Asia as well as North America.

Eiten's comments (1963, p. 304–305) on variability in the species are insightful and repeated here: "Very variable, both as between east Asia and North America, and within each region. I have not seen enough material from east Asia to determine if it is useful to set up subspecies. In North America all the variation that is regionally based is too intergrading to set up useful infraspecific categories. The most distinctive geographically-based character is the presence of hairs on the upper surface of the leaflets. This is most frequent in the Midwest, but even there less than half the collections in each state have this feature, and sometimes it varies even within single populations. This and other characters that have been used to set up infraspecific groups (presence of septate hairs on stems or on pedicels) often vary in the same population or even on the same plant, and present all intergrades of expression. In addition, the extreme expressions of characters that vary regionally center in different areas, i.e., they do not vary together. The introduced European plants represent a small part of the North American variation, in general being less pubescent. They are not at all like the plants of east Asia."

7. *Oxalis grandis* Small, Bull. Torrey Bot. Club 21:475. 1894. *Xanthoxalis grandis* (Small) Small, Fl. S.E. U.S. 668. 1903. TYPE: U.S.A. PENNSYLVANIA. [Bradford Co.]: Wysox, Jul 1836, J. Carey s.n. (LECTOTYPE, Eiten 1963: NY, NY-digital image!; ISOLECTOTYPE: GH!).

Oxalis recurva Trel., Mem. Boston Soc. Nat. Hist. 4:89. 1888 (not Elliott 1821). Fide Wiegand (1925).

Plants perennial, caulescent, arising from slender, lignescent, stoloniform rhizomes without tubers. **Stems** erect, usually single from the base (rarely 2–3 together), (10–)25–60(–100) cm before branching, nearly glabrous to sparsely or densely pilose or villous with a mixture of septate and nonseptate hairs. **Stipules** absent. **Leaves** cauline, mostly on the distal half of the stem; leaflets 3, obcordate, lobed 1/5 length, 5–25(–30) mm, upper shoulders of lobes usually rounded, rarely flattened, green on both surfaces, margins sometimes narrowly brownish-purple, ciliate, petioles 5–7.5 cm. **Flowers** 1 or 2–4(–8) in regular or irregular cymes or umbelliform cymes produced above the level of the leaves, tristylous; peduncles 7–12 cm; pedicels in fruit erect to ascending; petals 10–14 mm, yellow, throat yellow to faintly or weakly red-lined within. **Capsules** ovoid to ovoid-oblong, 6–10 mm long. **Seeds** brown, traverse ridges rarely whitish. $2n = 28$ (fide Weller & Denton 1976, reporting unpublished counts by Ornduff).

Flowering May–Aug. Sandy woods and alluvial soils; 100–1100 m. Ala.!, D.C.!, Ga.!, Ind.!, Ky.!, Md.!, N.C.!, Ohio.!, Penn.!, S.C.!, Tenn.!, Va.!, W.Va.!

A report of *Oxalis grandis* from southern Mississippi (Forrest Co.; Carter & Jones 1968) is far out of range and habitat for the species and probably is based on a misidentification, perhaps of *O. priceae*, which also is large-flowered.

8. *Oxalis illinoensis* Schwegm., Phytologia 50:467. 1982. TYPE: U.S.A. TENNESSEE. Macon Co.: by Tenn. [Hwy] 10, S side of and below Lafayette, steep, deep hardwood ravine, clay loam, 5 May 1975, R. Kral 55218 (NEOTYPE, designated here: MO!; ISONEOTYPE: VDB!). The neotype and isoneotype clearly show the diagnostic features of the rhizome and inflorescence. Alas, the collection is not from Illinois, but the geographically geometric center of the range is in eastern Kentucky and the species barely occurs in Illinois (comments below). The holotype was deposited at SIU but cannot now be located there and is presumed to have been destroyed: Illinois. Pope Co.: Wooded floodplain forest along Little Lusk Creek at Martha's Woods, 4 miles ENE of Eddyville, 11 May 1968, J.E. Schwegman 1661.

Plants perennial, caulescent, arising from slender, herbaceous rhizomes at intervals producing white fusi-form tubers or tuberlike thickenings. **Stems** erect, usually single from the base (rarely 2–3 together), 15–40 cm, nearly glabrous or sparsely to densely villous with a mixture of septate and nonseptate hairs. **Stipules** obsolescent, without free margins or apical auricles. **Leaves** cauline; leaflets 3, obcordate, lobed 1/5 length, (12–)20–30(–35) mm, upper shoulders of lobes flat, green on both surfaces, margins green, ciliate, petioles 4–7.5 cm long. **Flowers** 1–3(–6) in regular or irregular cymes produced mostly at the level of the leaves, tristylous; peduncles 3–10 cm, pedicels in fruit erect to ascending; petals 12–18 mm, yellow, throat strongly red-lined within. **Capsules** oblong-ovoid, 7–10 mm. **Seeds** brown, traverse ridges rarely whitish. $2n =$ unknown.

Flowering Apr–Sep. Slopes, bluffs, ravines, floodplains, mesic forests, sometimes forming the dominant ground cover, commonly on limestone, shale, or calcareous loess substrate; 200–500 m; s Ill., s Ind., w Ky., and c Tenn.

Differences between *Oxalis illinoensis* and *O. grandis* are subtle but they appear to be correlated with geography; the tuberous portions of the *O. illinoensis* rhizomes are diagnostic but they commonly are broken off during collection. *Oxalis illinoensis* apparently occupies the western part of the range of *O. grandis* sensu lato; the two species appear to be closely contiguous (non-overlapping or barely overlapping) in range in Tennessee (Univ. of Tennessee Herbarium 2008; personally confirmed by study of many collections at BRIT/VDB and MO). Michael Homoya (pers. comm.), of the Indiana Dept. of Natural Resources, observes that the two species overlap in range in southern Indiana, where they are mostly separated by habitat, with “*Oxalis grandis* on the drier, more acidic slopes, and *O. illinoensis* in the mesic, alkaline environments.” *Oxalis illinoensis* in Illinois is known from only three counties immediately bordering Indiana and Kentucky, and is state-listed as endangered (S1, Illinois Endangered Species Protection Board 1999). John Schwegman (pers. comm.) observes that he has never seen *O. grandis* in Illinois, nor have I seen any collections (MO). County-level distribution records in Indiana and Kentucky shown by USDA, NRCS (2008) need to be reexamined.

Medley (1993) has observed that *Oxalis illinoensis* and *O. grandis* intergrade, and a hybrid population is said to exist in Indiana (Heikens 2003, citing unpublished and undocumented observations by S. Olson).

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